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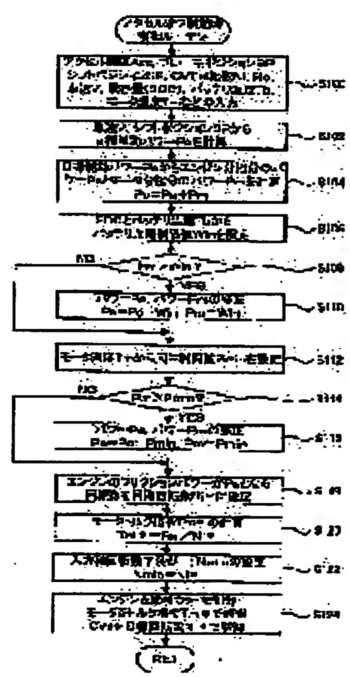
(54) HYBRID CAR

(57)Abstract:
PROBLEM TO BE SOLVED: To stabilize the braking force in the off-state of an accelerator and improve the dynamic characteristic in the on-state of the accelerator.
SOLUTION: The target braking power Po in the off-state of the accelerator is split into the braking power Pe by the frictional force of an engine and the braking power Pm by the regenerative control of a motor (S104), and when the braking power Pm is larger than the battery charging limit value Vin determined according to the SOC and the battery temperature Rb and the regenerative limit value Pmin determined according to the motor temperature Tm, it is limited by the respective limit values, and the braking power Pe is corrected (S106 to S116). According to the corrected braking power Pe, the target rotational frequency Ni of an input shaft of the CVT is set (S118), and used as a lower limit guard value of the rotational frequency of the input shaft in the on-state of the accelerator. Thus, the braking force in the off-state of the accelerator is stabilized, and the dynamic characteristic in the on-state of the accelerator can be improved.



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CLAIMS

[Claim(s)]
[Claim 1] It is a hybrid car equipped with the change gear which has the output shaft connected to the input shaft which inputs the driving force from an internal combustion engine, and the driving force from a motor, and the axle, changes gears and outputs the driving force of this input shaft to this output shaft. When the damping force at the time of accelerator-off is instructed to be a demand power directions means to direct demand power based on the directions from the operational status and/or the operator of a car as this demand power, A hybrid car equipped with a braking tense means to control said internal combustion engine, said motor, and said change gear so that the directed this damping force is in agreement with the sum of the damping force by said internal combustion engine's rotational resistance, and the damping force by the regenerative control of said motor.
[Claim 2] Said braking tense means is a hybrid car according to claim 1 which is a means to control said change gear so that the regeneration current of said motor becomes small and said internal combustion engine's engine speed becomes large.
[Claim 3] It is the hybrid car which is a hybrid car according to claim 1 or 2, and is the means which is equipped with said motor, the rechargeable battery which performs an exchange of power, and a cell condition detection means to detect the condition of this rechargeable battery, and carries out regenerative control of said motor based on the condition of a rechargeable battery that said braking tense means was detected by said cell condition detection means.
[Claim 4] Said braking tense means is a hybrid car which is a means to control said change gear so that it is a hybrid car according to claim 3, and said cell condition detection means is a means to detect the remaining capacity of this rechargeable battery as one of the conditions of said rechargeable battery, the remaining capacity of said rechargeable battery is large and the regeneration power of said motor becomes small.
[Claim 5] It is the hybrid car which is the means which is equipped with claim 1 thru/or a motor temperature detection means to be the hybrid car of a publication 4 either and to detect the temperature of said motor, and carries out regenerative control of said motor based on the temperature of the motor with which said braking tense means was detected by said motor temperature detection means.
[Claim 6] Said braking tense means is a hybrid car according to claim 5 which is a means to control said change gear so that the temperature of said motor is high and the regeneration power of this motor becomes small.
[Claim 7] Claim 1 thru/or when it is the hybrid car of a publication 6 either and driving force is directed as said demand power by said demand power directions means, A drive tense means to control said internal combustion engine, said motor, and said change gear so that the directed this driving force is in agreement with the sum of the driving force from said internal combustion engine, and the driving force from said motor, It has an input-shaft lower limit setting means to set up the rotational frequency of the input shaft of said change gear when being controlled by said braking tense means as an input-shaft lower limit. Said drive tense means When directions of said demand power by said demand power directions means are changed into the driving force at the time of accelerator-on from the damping force at the time of accelerator-off The hybrid

car which is a means to control this change gear within limits which become more than the input-shaft lower limit to which the rotational frequency of the input shaft of said change gear was set by said input-shaft lower limit setting means.
[Claim 8] Said drive tense means is a hybrid car according to claim 7 which is a means to control this change gear within limits which become more than the input-shaft lower limit to which the rotational frequency of the input shaft of said change gear was set by said input-shaft lower limit setting means [predetermined time] when directions of said demand power by said demand power directions means were changed into the driving force at the time of accelerator-on from the damping force at the time of accelerator-off.
[Claim 9] There is no claim 1 which is a nonstep variable speed gear, and said change gear is the hybrid car of a publication 8 either.

[Translation done.]

* NOTICES *

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1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to a hybrid car equipped with the change gear which has the output shaft connected to the input shaft which inputs the driving force from an internal combustion engine, and the driving force from a motor, and the axle in detail about a hybrid car.
[0002]
[Description of the Prior Art] Conventionally, what carries out the minimum guard of the rotational frequency of the input shaft of a nonstep variable speed gear as this kind of an automobile according to inclination and the vehicle speed is proposed (for example, JP,7-71556,A etc.). By this automobile, it is going to aim at improvement in the dynamic characteristics when carrying out accelerator-on from the time of the moderation at the time of accelerator-off by controlling a nonstep variable speed gear to become more than the lower limit that the rotational frequency of an input shaft set up.
[0003]
[Problem(s) to be Solved by the Invention] However, in a hybrid car equipped with the nonstep variable speed gear which inputs the driving force from an internal combustion engine, and the driving force from a motor, and changes gears, at the time of the moderation at the time of accelerator-off, if the damping force by carrying out regenerative control of the motor in addition to the damping force by an internal combustion engine's frictional force can be considered and the energy efficiency of the whole car is taken into consideration, it will become an important thing to acquire the damping force by carrying out regenerative control of the motor. Since the regenerative control of a motor changes with the conditions of a rechargeable battery of accepting not only the engine performance of a motor but regeneration power etc., the damping force at the time of moderation will also change with the regenerative control of a motor. In the condition that such damping force does not become settled, either, even if it sets up the lower limit of the input shaft of a nonstep variable speed gear only based on inclination and the vehicle speed, when accelerator-on is carried out, good dynamic characteristics is not acquired in many cases.
[0004] The hybrid car of this invention sets to stabilize the damping force at the time of accelerator-off to one of the purposes. Moreover, the hybrid car of this invention sets to raise the dynamic characteristics when carrying out accelerator-on to one of the purposes.
[0005]
[The means for solving a technical problem, and its operation and effectiveness] The hybrid car of this invention took the following means, in order to attain a part of above-mentioned purpose [at least].
[0006] The hybrid car of this invention is a hybrid car equipped with the change gear which has the output shaft connected to the input shaft which inputs the driving force from an internal combustion engine, and the driving force from a motor, and the axle, changes gears and outputs the driving force of this input shaft to this output shaft. When the damping force at the time of accelerator-off is instructed to be a demand power directions means to direct demand power

based on the directions from the operational status and/or the operator of a car as this demand power, Let it be a summary to have a braking tense means to control said internal combustion engine, said motor, and said change gear so that the directed this damping force is in agreement with the sum of the damping force by said internal combustion engine's rotational resistance, and the damping force by the regenerative control of said motor.

[0007] Since an internal combustion engine, a motor, and a change gear are controlled by the hybrid car of this this invention so that the directed damping force is in agreement with the sum of the damping force by an internal combustion engine's rotational resistance, and the damping force by the regenerative control of a motor, it can prevent that damping force changes according to the condition of a device, and the stable damping force can be made to act. In addition, a nonstep variable speed gear shall be used as a change gear.

[0008] In the hybrid car of such this invention, said braking tense means shall be a means to control said change gear so that said internal combustion engine's rotational frequency becomes large, so that the regeneration current of said motor becomes small. If the regeneration current of a motor becomes small, since the regeneration torque of a motor will become small and the damping force from a motor will also become small, the directed damping force can be made to act by enlarging an internal combustion engine's rotational frequency and enlarging damping force by an internal combustion engine's frictional force.

[0009] Moreover, in the hybrid car of this invention, it shall have said motor, the rechargeable battery which performs an exchange of power, and a cell condition detection means to detect the condition of this rechargeable battery, and said braking tense means shall be a means which carries out regenerative control of said motor based on the condition of the rechargeable battery detected by said cell condition detection means. If it carries out like this, overcharge of a rechargeable battery and charge by excessive power are avoidable. In the hybrid car of this invention of this mode, said cell condition detection means shall be a means to detect the remaining capacity of this rechargeable battery as one of the conditions of said rechargeable battery, and said braking tense means shall be a means to control said change gear so that the regeneration power of said motor becomes small, so that the remaining capacity of said rechargeable battery is large.

[0010] Furthermore, in the hybrid car of this invention, it shall have a motor temperature detection means to detect the temperature of said motor, and said braking tense means shall be a means which carries out regenerative control of said motor based on the temperature of the motor detected by said motor temperature detection means. If it carries out like this, a motor can be driven more proper. In the hybrid car of this invention of this mode, said braking tense means shall be a means to control said change gear so that the regeneration power of this motor becomes small, so that the temperature of said motor is high. If it carries out like this, abnormality generation of heat of a motor can be prevented.

[0011] In the hybrid car of this invention A drive tense means to control said internal combustion engine, said motor, and said change gear so that the driving force this directed when driving force was directed as said demand power by said demand power directions means is in agreement with the sum of the driving force from said internal combustion engine, and the driving force from said motor, It has an input-shaft lower limit setting means to set up the rotational frequency of the input shaft of said change gear when being controlled by said braking tense means as an input-shaft lower limit. Said drive tense means When directions of said demand power by said demand power directions means are changed into the driving force at the time of accelerator-on from the damping force at the time of accelerator-off It shall be a means to control this change gear within limits which become more than the input-shaft lower limit to which the rotational frequency of the input shaft of said change gear was set by said input-shaft lower limit setting means. If it carries out like this, when it changes from braking directions to drive directions, aggravation of the dynamic characteristics of the car by the change gear ratio of a change gear being rapidly changed for improvement in an internal combustion engine's effectiveness etc. can be prevented. That is, the dynamic characteristics of a car can be raised. In the hybrid car of this invention of this mode, said drive tense means shall be a means to control this change gear within limits which become more than the input-shaft lower limit to

which the rotational frequency of the input shaft of said change gear was set by said input-shaft lower limit setting means [predetermined time], when directions of said demand power by said demand power directions means are changed into the driving force at the time of accelerator-on from the damping force at the time of accelerator-off. Since it can be made to shift to operational status with energy efficiency high as a whole after being changed into drive directions from braking directions and carrying out predetermined time progress, if it carries out like this, improvement in the dynamic characteristics of a car and improvement in energy efficiency can be aimed at.

[0012]

[Embodiment of the Invention] Next, the gestalt of operation of this invention is explained using an example. Drawing 1 is the block diagram showing the outline of the configuration of the hybrid car 20 which is one example of this invention. The hybrid car 20 of an example is equipped with an engine 22, the planetary gear 30 connected to the crankshaft 24 as an output shaft of an engine 22, the motor 40 which was connected to planetary gear 30 and which can be generated, CVT50 as a nonstep variable speed gear connected to driving wheels 66a and 66b through the differential gear 64 while connecting with planetary gear 30, and the electronic control unit 70 for hybrids which controls the whole equipment so that it may illustrate.

[0013] An engine 22 is an internal combustion engine which outputs power with the fuel of hydrocarbon systems, such as a gasoline or gas oil, and while generating the power supplied to the auxiliary machinery which is not illustrated, the starter motor 26 which puts an engine 22 into operation is attached in the crankshaft 24 of an engine 22 with the belt 28. The operation control of an engine 22, for example, fuel-injection control, ignition control, inhalation air-adjust control, etc. are performed by the electronic control unit 29 for engines (henceforth Engine ECU). The engine ECU 29 is communicating with the electronic control unit 70 for hybrids, and it outputs the data about the operational status of an engine 22 to the electronic control unit 70 for hybrids if needed while it carries out the operation control of the engine 22 with the control signal from the electronic control unit 70 for hybrids.

[0014] The ring wheel 32 of the internal gear with which planetary gear 30 have been arranged on an external-tooth gearing's sun gear 31, this sun gear 31, and a concentric circle, The 1st pinion gear 33 which gears to a sun gear 31, and the 2nd pinion gear 34 which gears with this 1st pinion gear 33 and ring wheel 32, It has the carrier 35 which holds the 1st pinion gear 33 and the 2nd pinion gear 34 free [rotation and revolution], and a differential operation is performed by using a sun gear 31, a ring wheel 32, and a carrier 35 as a rotation element. The crankshaft 24 of an engine 22 is connected with the sun gear 31 of planetary gear 30, the revolving shaft 41 of a motor 40 is connected with the carrier 35, respectively, and while inputting the output of an engine 22 from a sun gear 31, the exchange of a motor 40 and an output can be performed through a carrier 35. With a clutch C1, a carrier 35 forbids the differential by the sun gear 31, the ring wheel 32, and three rotation elements of a carrier 35 by being able to connect a ring wheel 32 now to the input shaft 51 of CVT50 with a clutch C2, and making a clutch C1 and a clutch C2 into a connection condition, and let the body of revolution of one, i.e., the crankshaft 24 of an engine 22, the revolving shaft 41 of a motor 40, and the input shaft 51 of CVT50, be the body of revolution of one. In addition, the brake B1 which fixes a ring wheel 32 to a case 39, and forbids the rotation to planetary gear 30 is also formed.

[0015] A motor 40 is constituted as a synchronous generator motor of the common knowledge which can be driven as a motor while being able to drive it as a generator, and it performs an exchange of a rechargeable battery 44 and power through an inverter 43. Drive control of the motor 40 is carried out with the electronic control unit 49 for motors (henceforth Motor ECU). On a motor ECU 49 A signal required to manage a signal and a rechargeable battery 44 required in order to carry out drive control of the motor 40, By for example, the signal and the current sensor which is not illustrated from the rotation location detection sensor 45 which detects the rotation location of the rotator of a motor 40 The temperature of the phase current and the motor 40 which are impressed to the motor 40 detected The motor temperature from temperature sensor 45b to detect, The electrical potential difference between terminals from the voltage sensor 46 installed between the terminals of a rechargeable battery 44, the charge and

discharge current from the current sensor 47 attached in power Rhine from the rechargeable battery 44, the cell temperature from the temperature sensor 48 attached in the rechargeable battery 44, etc. are inputted. From the motor ECU 49, the switching control signal to an inverter 43 is outputted. By the motor ECU 49, in order to manage a rechargeable battery 44, remaining capacity (SOC) is calculated based on the addition value of the charge and discharge current detected by the current sensor 47. In addition, the motor ECU 49 is communicating with the electronic control unit 70 for hybrids, and it outputs the data about the operational status of a motor 40, or the condition of a rechargeable battery 44 to the electronic control unit 70 for hybrids if needed while it carries out drive control of the motor 40 with the control signal from the electronic control unit 70 for hybrids.

[0016] The primary pulley 53 which CVT50 could change the flute width and was connected to the input shaft 51, The secondary pulley 54 which could similarly change the flute width and was connected to the main shaft 52 as a driving shaft, The belt 55 constructed in the slot of the primary pulley 53 and the secondary pulley 54, It has the 1st actuator 56 and the 2nd actuator 57 which change the flute width of the primary pulley 53 and the secondary pulley 54. By changing the flute width of the primary pulley 53 and the secondary pulley 54 with the 1st actuator 56 and the 2nd actuator 57, it changes gears to a stepless story and the power of an input shaft 51 is outputted to a main shaft 52. Control of the change gear ratio of CVT50 is performed by the electronic control unit 59 for CVT (henceforth CVTECU). The rotational frequency of the input shaft 51 from the rotational frequency sensor 61 attached in the input shaft 51 and the rotational frequency of the main shaft 52 from the rotational frequency sensor 62 attached in the main shaft 52 are inputted into this CVTECU59, and the driving signal to the 1st actuator 56 and the 2nd actuator 57 is outputted from CVTECU59. Moreover, CVTECU59 is communicating with the electronic control unit 70 for hybrids, and it outputs the data about the operational status of CVT50 to the electronic control unit 70 for hybrids if needed while it controls the change gear ratio of CVT50 by the control signal from the electronic control unit 70 for hybrids.

[0017] The electronic control unit 70 for hybrids is constituted as a microprocessor centering on CPU72, and is equipped with ROM74 which memorizes the processing program other than CPU72, RAM76 which memorizes data temporarily, and the input/output port and the communication link port which is not illustrated. In the electronic control unit 70 for hybrids The shift position SP from the shift position sensor 81 which detects the rotational frequency nickel of the input shaft 51 from the rotational frequency sensor 61, the rotational frequency No of the main shaft 52 from the rotational frequency sensor 62, and the actuated valve position of a shift lever 80, and the amount of treading in of an accelerator pedal 82 The vehicle speed V from the brake-pedal position BP and speed sensor 86 from the brake-pedal position sensor 85 which detects the accelerator opening A from the accelerator pedal position sensor 83 to detect and the amount of treading in of a brake pedal 84 etc. is inputted through input port. Moreover, from the electronic control unit 70 for hybrids, the driving signal to a clutch C1 or a clutch C2, the driving signal to a brake B1, etc. are outputted through the output port. Moreover, it connects with an engine ECU 29 and motors ECU49 and CVTECU59 through the communication link port, and the electronic control unit 70 for hybrids is performing the exchange of an engine ECU 29, motors ECU49 and CVTECU59, and various control signals and data, as mentioned above.

[0018] Next, the actuation at the time of acting the damping force at the time of actuation of the hybrid car 20 of the example constituted in this way, especially accelerator-off and the actuation when carrying out accelerator-on from accelerator-off are explained. Drawing 2 is a flow chart which shows an example of the accelerator-off braking tense routine performed with the electronic control unit 70 for hybrids. This routine is repeatedly performed for every (every [for example,] 8msec) predetermined time, when accelerator-off of a clutch C1 and the clutch C2 is carried out in the state of connection.

[0019] When an accelerator off braking tense routine is performed, first The brake-pedal position BP, the shift position SP from the shift position sensor 81, the rotational frequency sensor 61 from the accelerator opening Acc or the brake-pedal position sensor 85 from the accelerator pedal position sensor 83 By and the remaining capacity (SOC) and temperature sensor 45b

which are transmitted from the rotational frequencies nickel and No from the rotational frequency sensor 62, the vehicle speed V from a speed sensor 86, and a motor ECU 49 Processing which reads data required for control of the dc-battery temperature Tb detected by the motor temperature Tm detected and the temperature sensor 48 is performed (step S100).
[0020] Then, the target braking power Po which should be made to act on driving wheels 66a and 66b is calculated from the read vehicle speed V and the shift position SP (step S102). It is memorized to ROM74, count of the target braking power Po responding for example, to the shift position SP, setting up beforehand the torque for moderation on a main shaft 52, and using it as a map, and can be performed by multiplying the torque which drew the torque corresponding to the shift position SP, and was drawn by the rotational frequency No of a main shaft 52 from the map etc. In this way, count of the target braking power Po calculates from the calculated target braking power Po (step S104)., the damping force Pe which acts by rotational resistance, such as frictional force of an engine 22, and a pumping loss, i.e., the braking power shared with an engine 22, and the damping force Pm acquired by carrying out regenerative control of the motor 40, i.e., the braking power shared by the motor 40 In order that the braking power Pe and the braking power Pm may raise the effectiveness of a hybrid car 20, it is possible to set up so that the conditions from which regeneration power is obtained as much as possible, and the conditions with which are satisfied of the relation of Po=Pe+Pm may be fulfilled. Beforehand in quest of the relation between the target braking power Po, and the vehicle speed V, the shift position SP and the braking power Pm, it specifically memorizes to ROM74 as a map by experiment etc. so that many regeneration power may be obtained as much as possible. If the target braking power Po, the vehicle speed V, and the shift position SP are given, the braking power Pm which corresponds from a map is drawn, and from the braking power Pm and the target braking power Po which were drawn, it can carry out like calculating the braking power Pe, and can ask. In addition, although what is set up so that the conditions from which regeneration power is obtained as much as possible in the braking power Pe and the braking power Pm as an example, and the conditions with which are satisfied of the relation of Po=Pe+Pm may be fulfilled was mentioned and explained, it is not limited to this, and if the conditions of Po=Pe+Pm are fulfilled, it will be available [what kind of allocation] also as what sets up the braking power Pe and the braking power Pm.
[0021] Next, the dc-battery charge limiting value Win is set up from the remaining capacity (SOC) of a rechargeable battery 44, and the dc-battery temperature Tb (step S106). This dc-battery charge limiting value Win shall derive the dc-battery charge limiting value Win from a map, when it becomes settled according to the engine performance and condition of a rechargeable battery 44, it memorizes to ROM74 as a map beforehand in quest of the relation between remaining capacity (SOC), and the dc-battery temperature Tb and the dc-battery charge limiting value Win by experiment etc. in the example and remaining capacity (SOC) and the dc-battery temperature Tb are given. In this way, the braking power Pm which will be shared by the set-up dc-battery charge limiting value Win and the motor 40 if the dc-battery charge limiting value Win is set up is compared (step S108), and when the braking power Pm is larger than the dc-battery charge limiting value Win (an absolute value is large), while re-calculating the braking power Pe shared with an engine 22 by Pe=Po-Win and correcting it, the braking power Pm shared by the motor 40 is reset by Pm=Win, and is corrected (step S110). It is correcting here so greatly [the correction of the braking power Pe which the limits by the dc-battery charge limiting value Win of the braking power Pm are a limit of the regeneration current of a motor 40 and a limit of regeneration torque, and is shared with an engine 22 is so large that it restricts the regeneration current of a motor 40 small, or] that the regeneration torque of a motor 40 being restricted small. In addition, such correction of the braking power Pe will correct the rotational frequency of an engine 22 greatly since it becomes correction of the rotational frequency of an engine 22 so that it may mention later, so that the regeneration current of a motor 40 is restricted small, or, so that it restricts the regeneration torque of a motor 40 small. In addition, when the braking power Pm is below the dc-battery charge limiting value Win (below the ****** with the same absolute value), neither the braking power Pe nor the braking power Pm is corrected.

[0022] After carrying out limit processing by the dc-battery charge limiting value Win of such a rechargeable battery 44, based on the motor temperature Tm, the regeneration limiting value Pmin of a motor 40 is set up (step S114), and limit processing by the regeneration limiting value Pmin is performed (steps S114 and S116). Here, the regeneration limiting value Pmin shall derive the regeneration limiting value Pmin from a map, when it becomes settled with engine performance, cooling engine performance, etc. of a motor 40, it memorizes to ROM74 as a map beforehand in quest of the relation between the motor temperature Tm and the regeneration limiting value Pmin by experiment etc. in the example and the motor temperature Tm is given. In addition, the map used in the example is set up so that the motor temperature Tm becomes high, and the regeneration limiting value Pmin may become small. That is, it is set up so that the motor temperature Tm becomes high so that the regeneration current which flows in the coil of a motor 40, so that the motor temperature Tm becomes high may be made small or, and torque for the regeneration of a motor 40 may be made small. Specifically, limit processing by the regeneration limiting value Pmin is performed by resetting the braking power Pm shared by the motor 40 by Pm=Pmin, and correcting it while re-calculating the braking power Pe shared with an engine 22 by Pe=Po-Pmin and correcting it, when the braking power Pm is larger than the regeneration limiting value Pmin (an absolute value is large). In addition, when the braking power Pm is below the regeneration limiting value Pmin (below the ****** with the same absolute value), of course, neither the braking power Pe nor the braking power Pm is corrected.
[0023] In this way, if the braking power Pe and the braking power Pm are set up, the friction power of an engine 22 will set the rotational frequency used as the braking power Pe as target rotational frequency nickel* of an input shaft 51 (step S118). Since a clutch C1 and a clutch C2 are in a connection condition as mentioned above, a sun gear 31, and a ring wheel 32 and a carrier 35 also rotate planetary gear 30 as one. Therefore, since an input shaft 51 is rotated as a crankshaft 24 and one, number nickelof target rotations * is also the number of target rotations of an engine 22, and the number of target rotations of a motor 40. And while **(ing) braking power Pm by target rotational frequency nickel* and setting up torque command Tm* of a motor 40 (step S120) Target rotational frequency nickel* is set up as an input-shaft rotational frequency minimum guard Nmin (step S122). While controlling an engine 22 by the fuel cut, a motor 40 is controlled by torque command Tm*, it controls so that an input shaft 51 rotates CVT50 by target engine-speed nickel* (step S124), and this routine is ended. About the input-shaft rotational frequency minimum guard Nmin, it mentions later. Control of step S124 in an engine ECU 29 from the electronic control unit 70 for hybrids specifically a fuel cut By outputting torque command Tm* to a motor ECU 49, and outputting target rotational frequency nickel* to CVTECU59 as a control signal respectively When an engine ECU 29 controls an engine 22 to cut the fuel to an engine 22 It is carried out, when a motor ECU 49 controls a motor 40 so that the torque of torque command Tm* is outputted from a motor 40, and CVTECU59 controls CVT50 so that an input shaft 51 rotates by target rotational frequency nickel*.
[0024] By performing the accelerator-off braking tense routine explained above, the damping force at the time of accelerator-off can be provided with the damping force by the rotational resistance of an engine 22, and the damping force by the regenerative control of a motor 40. And since the dc-battery charge limiting value Win based on the remaining capacity (SOC) of a rechargeable battery 44 or the dc-battery temperature Tb restricts the braking power Pm of a motor 40, it can charge with excessive power or a rechargeable battery 44 can be prevented from overcharging. Moreover, since the regeneration limiting value Pmin based on the motor temperature Tm restricts the braking power Pm of a motor 40, unusual generation of heat of a motor 40 etc. can be prevented. Moreover, since the power which runs short by the limit of the braking power Pm shared by such motor 40 is provided by the braking power Pe shared with an engine 22, it can output the target braking power Po irrespective of a limit of the braking power Pm to a main shaft 66a and 52 66b, i.e., driving wheels.
[0025] In addition, by the accelerator off braking tense routine of an example, after the dc-battery charge limiting value Win restricted the braking power Pm shared by the motor 40, the regeneration limiting value Pmin restricted, but any are sufficient as the sequence, and after it

restricts the braking power Pm with the regeneration limiting value Pmin, the dc-battery charge limiting value Win may restrict it.
[0026] Moreover, although the regeneration limiting value Pmin restricted by the accelerator off braking tense routine of an example after the dc-battery charge limiting value Win restricted the braking power Pm shared by the motor 40 Although the dc-battery charge limiting value Win restricts the braking power Pm, the regeneration limiting value Pmin shall not restrict, or Although the regeneration limiting value Pmin restricts the braking power Pm, it shall not restrict depending on the dc-battery charge limiting value Win, or it does not matter as what does not restrict the braking power Pm with the dc-battery charge limiting value Win or the regeneration limiting value Pmin, either. When not restricting the braking power Pm with the dc-battery charge limiting value Win or the regeneration limiting value Pmin, either, since the input-shaft engine-speed minimum guard Nmin becomes the value which becomes settled uniquely from the vehicle speed V, the shift position SP, etc., he does not need to set up at step S122. About this, it mentions later.
[0027] Next, the actuation when carrying out accelerator-on from accelerator-off among actuation of the hybrid car 20 of an example is explained. Drawing 3 is a flow chart which shows an example of the accelerator-on drive tense routine performed with the electronic control unit 70 for hybrids. This routine is repeatedly performed for every (every [for example,] 8msec) predetermined time, when accelerator-off of a clutch C1 and the clutch C2 is carried out in the state of connection.
[0028] When an accelerator-on drive tense routine is performed, CPU72 of the electronic control unit 70 for hybrids First, the accelerator opening Acc, the brake-pedal position BP, the shift position SP, rotational frequencies nickel and No, the vehicle speed V, remaining capacity of a rechargeable battery 44 (SOC), Data required for control of the motor temperature Tm, the dc-battery temperature Tb, etc. are read (step S200), and the target drive power Po which should be made to act on driving wheels 66a and 66b is calculated from the read accelerator opening Acc or the vehicle speed V (step S202). Count of the target drive power Po is beforehand memorized to ROM74 as a map in quest of the accelerator opening Acc, the vehicle speed V, and relation with the target drive power Po by experiment etc., and if the accelerator opening Acc and the vehicle speed V are given, it can be performed by deriving the target drive power Po which corresponds from a map etc. In addition, in the example, since it was the power which makes the target drive power Po and the target braking power Po act on a main shaft 52, it decided to use the same sign (Po).
[0029] Then, the charge-and-discharge power Pb is set up from the remaining capacity (SOC) of a rechargeable battery 44 (step S204). Here, the charge-and-discharge power Pb is set up as discharge power, when remaining capacity (SOC) is large, and when remaining capacity (SOC) is conversely small, it is set up as charge power. A setup of the charge-and-discharge power Pb asks for the relation between remaining capacity (SOC) and the charge-and-discharge power Pb by experiment etc. in consideration of the engine performance of a rechargeable battery 44 etc., memorizes it to ROM74 beforehand, and if remaining capacity (SOC) is given, it can be performed by deriving the charge-and-discharge power Pb which corresponds from a map. A setup of the charge-and-discharge power Pb sets up demand power Pe* which adds the target drive power Po to the set-up charge-and-discharge power Pb, and is required of an engine 22 (step S206). Although demand power Pe* shall be calculated by Pe*=Po+Pb in the example since explanation is easy, what **(ed) the right-hand side at the effectiveness of an engine 22 in fact is set as demand power Pe*.
[0030] And based on set-up demand power Pe*, target torque Te* of an engine 22 and target rotational frequency nickel* are set up (step S208). Target torque Te* and target engine-speed nickel* can consider setting up demand power Pe* so that it may become the highest operation point of effectiveness among the operation points of the engine 22 in which an output is possible. A setup of target torque Te* and target rotational frequency nickel* Demand power Pe* and demand power Pe* are specifically beforehand memorized to ROM74 as a map in quest of the relation between the torque as the highest operation point of effectiveness, and a rotational frequency by experiment etc. among the operation points of the engine 22 in which an

output is possible. If demand power Pe* is given, the torque and the rotational frequency which correspond from a map can be drawn, and it can carry out by setting up the torque and the rotational frequency which were drawn as target torque Te* and target rotational frequency nickel*. In addition, although what sets the torque and the rotational frequency as the highest operation point of effectiveness as target torque Te* and target rotational frequency nickel* among the operation points of the engine 22 in which an output of demand power Pe* is possible as an example was mentioned and explained If the relation of Pe*=Te*xnickel* instead of what is limited to this is filled, it will not matter as what makes what kind of the operation point target torque Te* and target rotational frequency nickel*.

[0031] Next, when having not judged and (step S210) carried out predetermined time progress of whether carried out accelerator-on from the condition of accelerator-off and predetermined time passed, the input-shaft rotational frequency minimum guard Nmin who set up at step S122 of the accelerator-off braking tense routine of drawing 2 is inputted (step S212), and the input-shaft rotational frequency minimum guard Nmin performs lower limit guard processing for target rotational frequency nickel* (steps S214 and S216). Here, performing lower limit guard processing to target rotational frequency nickel* is based on the setting technique of target rotational frequency nickel* differing in the time of braking at the time of accelerator-off, and the drive at the time of accelerator-on. Since an engine 22 is considered as the point operated efficiently to setting up target engine-speed nickel* and controlling CVT50 at the time of accelerator-on, target engine-speed nickel* is set up and CVT50 is controlled in order to acquire desired damping force by the rotational resistance of an engine 22 at the time of accelerator-off Immediately after carrying out accelerator-on from the condition of accelerator-off, target engine-speed nickel* changes suddenly and the case where rapid up shifting is performed with sudden change of the case where the good dynamic characteristics of a hybrid car 20 is not acquired, or target engine-speed nickel* arises. As for a fall and the rapid up shifting of such dynamic characteristics, the so-called drivability gets worse. In the example, in order to prevent aggravation of such drivability, lower limit guard processing is performed to target rotational frequency nickel*. Lower limit guard processing specifically compares target rotational frequency nickel* with the input-shaft rotational frequency minimum guard Nmin (step S214). When larger than the input-shaft rotational frequency minimum guard Nmin, while target rotational frequency nickel* sets the input-shaft rotational frequency minimum guard Nmin as target rotational frequency nickel* It is carried out by what (step S216) demand power Pe* is ** (ed) with the input-shaft rotational frequency minimum guard Nmin, and target torque Te* is set up for. When accelerator-on is carried out since it is set up as target engine-speed nickel* of an input shaft 51 as the input-shaft engine-speed minimum guard Nmin shows at step S122 of the accelerator-off braking tense routine of drawing 2 , it is the same as the engine speed nickel of the input shaft 51 at the time of accelerator-off, or an input shaft 51 is controlled by the engine speed higher than it. Consequently, a fall or the rapid up shifting of the dynamic characteristics of a hybrid car 20 do not arise. in addition, an accelerator -- carrying out accelerator-on from an off condition, and not performing lower limit guard processing, after carrying out predetermined time progress -- an accelerator -- the problem of aggravation of the drivability which may be produced when accelerator-on is carried out from an off condition is because it is not generated or the effect is small, after carrying out predetermined time progress. Therefore, predetermined time is set up as the time amount taken to solve the problem of aggravation of drivability, or time amount of the near, and is defined with an engine 22, the property of CVT50, etc.

[0032] In this way, if setup or lower limit guard processing is performed, target rotational frequency nickel* ** charge-and-discharge power Pb by target rotational frequency nickel*, and torque command Tm* of a motor 40 is set up (step S218). While controlling an engine 22 by target torque Te*, a motor 40 is controlled by torque command Tm*, it controls so that an input shaft 51 rotates CVT50 by target engine-speed nickel* (step S220), and this routine is ended. Control of step S220 in an engine ECU 29 from the electronic control unit 70 for hybrids specifically target torque Te* By outputting torque command Tm* to a motor ECU 49, and outputting target rotational frequency nickel* to CVTECU59 as a control signal respectively When an engine ECU 29 controls an engine 22 so that the torque of target torque Te* is

outputted from an engine 22 It is carried out, when a motor ECU 49 controls a motor 40 so that the torque of torque command Tm* is outputted from a motor 40, and CVTECU59 controls CVT50 so that an input shaft 51 rotates by target rotational frequency nickel*.
[0033] By performing lower limit guard processing of target rotational frequency nickel* by the accelerator-on drive tense routine explained above, aggravation of the drivability which may be produced when accelerator-on is carried out from the condition of accelerator-off can be prevented. And since lower limit guard processing of target engine-speed nickel* is not performed after carrying out accelerator-on from the condition of accelerator-off and carrying out predetermined time progress, an engine 22 can be operated on the efficient operation point, consequently the energy efficiency of a hybrid car 20 can be raised.
[0034] When the braking power Pm was not restricted with the dc-battery charge limiting value Win or the regeneration limiting value Pmin on the occasion of explanation of the accelerator-off braking tense routine of drawing 2 , either, since the input-shaft engine-speed minimum guard Nmin became the value which becomes settled uniquely from the vehicle speed V, the shift position SP, etc., he said that it is not necessary to set up at step S122. In this case, the input-shaft rotational frequency minimum guard Nmin can set up with the shift position SP and the vehicle speed V so that it may illustrate on the setting map of the input-shaft rotational frequency minimum guard Nmin of drawing 4 . In this case, the input-shaft engine-speed minimum guard Nmin in each shift position SP should just set up as an engine speed of the engine 22 when providing with the friction power of an engine 22 the braking power Pe shared with an engine 22 among the target braking power Po which becomes settled from the vehicle speed V to each shift position SP.
[0035] A change gear is not restricted to a nonstep variable speed gear, and the hybrid car 20 of an example is available for it also as what is applied to an owner stage change gear, although CVT50 as a nonstep variable speed gear shall be carried.
[0036] As mentioned above, although the gestalt of operation of this invention was explained using the example, as for this invention, it is needless to say that it can carry out with the gestalt which becomes various within limits which are not limited to such an example at all and do not deviate from the summary of this invention.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the block diagram showing the outline of the configuration of the hybrid car 20 which is one example of this invention.
[Drawing 2] It is the flow chart which shows an example of the accelerator off braking tense routine performed with the electronic control unit 70 for hybrids.
[Drawing 3] It is the flow chart which shows an example of the accelerator-on drive tense routine performed with the electronic control unit 70 for hybrids.
[Drawing 4] It is the explanatory view showing an example of the map which derives the input-shaft rotational frequency minimum guard Nmin by the vehicle speed V and the shift position SP.

[Description of Notations]
20 Hybrid Car, 22 Engine, 24 Crankshaft, 26 A starter motor, 28 A belt, 29 The electronic control unit for engines (engine ECU), 30 Planetary gear, 31 A sun gear, 32 Ring wheel, 33 The 1st pinion gear, 34 The 2nd pinion gear, 35 Carrier, 39 A case, 40 A motor, 41 A revolving shaft, 43 Inverter, 44 A rechargeable battery, 45 A rotation location detection sensor, 45b Temperature sensor, 46 A voltage sensor, 47 A current sensor, 48 A temperature sensor, 49 The electronic control unit for motors (motor ECU), 50 CVT, 51 An input shaft, 52 Main shaft, 53 A primary pulley, 54 A secondary pulley, 55 Belt, 56 The 1st actuator, the 57 2nd actuator, 59 The electronic control unit for CVT (CVTECU), 61 62 An engine-speed sensor, 64 A differential gear, 66a, 66b Driving wheel, 70 The electronic control unit for hybrids, 72 CPU, 74 ROM, 76 RAM, 80 A shift lever, 81 Shift position sensor, 82 An accelerator pedal, 83 An accelerator pedal position sensor, 84 brake pedals, 85 A brake-pedal position sensor, 86 A speed sensor, C1, C2 A clutch, B1 Brake.

[Translation done.]